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CONTAINERIZED AMMUNITION DELIVERY SYSTEM IN THE REPUBLIC OF KOREA: A STUDY TO DETERMINE THE SHORTFALLS AND LOGISTICAL INFRASTRUCTURE REQUIREMENTS

by

Michael S. Moore, Major, USAF

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Advisor: Lt. Col. Steven O. Purtle

Maxwell Air Force Base, Alabama

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Contents

Page

DISCLAIMER ii

ILLUSTRATIONS iv

TABLES v

PREFACE vi

ABSTRACT vii

INTRODUCTION 1

BACKGROUND 6
- Containerized Ammunition Delivery System 8
- Special Munitions Requirements 8
- Joint ISO Requirements 9
- Intermodal Requirements 13
- CADS Operations 14

ISSUES ANALYSIS 21
- USAF MOB/COB Deficiencies 21
- Railheads 21
- ISO Pads 24
- Roads 26
- Vehicles 28
- In-Transit Visibility 30

SUMMARY/CONCLUSIONS/RECOMMENDATIONS 36
- Summary 36
- Conclusions 37
- Recommendations 38

ISO DELIVERY CALCULATION FOR OSAN AB 43

GLOSSARY 45

BIBLIOGRAPHY 46

Illustrations

Page

Figure 1. American Merlin container ship 3

Figure 2. Unloading an ISO container from the American Merlin container ship 7

Figure 3. Chinhae Pier Facility 10

Figure 4. Moveable Crane - Chinhae Pier 11

Figure 5. Map of South Korea indicating Chinhae, Masan, and US MOBs/COBs 12

Figure 6. Theater ISO Flow Diagram 17

Tables

Page

Table 1: Munitions Inventory of the APF Ship MV Fisher 15

Preface

The topic addressed in this paper is of vital importance to the United States Air Force and government leaders at all levels because it identifies a serious safety risk to our armed forces. The work reflected here is the result of endless hours of labor contributed by a multitude of professionals in the munitions, maintenance, and academic fields. I hope this work can make a difference for the munitions personnel who train for and carry out the mission.

This project would never have occurred without the gracious assistance of so many other people and I would like to take this opportunity to personally thank everyone involved in helping get it off the ground. To all the USAF AMMO professionals whose time and expertise were invaluable – thank you: Colonel Wayne Recknor, Major Pat Minto, SMSgt Dan Mank, MSgt Dennis Addington, MSgt Craig Dye, MSgt Gary Hofstetter, MSgt Mark Eckert, and MSgt Joe Hughes. Without your insights and hard work, the argument could not have been substantiated. I also owe a debt of thanks to my faculty research advisor, Lieutenant Colonel Steve Purtle, who ensured that the argument was solid. Finally, I wish to thank a very special person, my wife Dr. Kathryn Moore. Her unyielding support and endless patience kept me motivated and focused.

Abstract

In the event of a second Korean War, the United States must be able to sustain its Air Force with food, fuel, and above all, ammunition. This paper is a comparison argument that examines the existing Department of Defense standards for supporting containerized ammunition delivery systems with the results of various staff and unit level reports, US Transportation Command sponsored exercises, and expert interviews. The analysis presented indicates widespread deficiencies in the ammunition-receiving infrastructure at United States Air Force bases in the Republic of Korea. There are inadequate railhead facilities, container handling pads, base road systems, vehicle support, and in-transit visibility capabilities. The analysis finds that the current system cannot support efficient and safe containerized ammunitions operations without great risk to both munitions handlers and base personnel. Furthermore, the present system does not meet the intermodal requirements mandated by Joint Vision 2010's operational concept Focused Logistics. The paper provides specific recommendations for building adequate infrastructure support for a safe and efficient containerized ammunition delivery system. Correcting these systemic deficiencies will require the dedicated support of the United States and South Korean governments, the Department of Defense, and the US Air Force.

Part 1

Introduction

As we move into the 21st Century, US interests are faced with a multitude of challenges, some of which may become threatening to US resources and those of our allied partners. Our US National Security Strategy (NSS) clearly states that our vital interests include "the physical security of our territory and that of our allies, the safety of our citizens, our economic well being and the protection of our critical infrastructures."[1] In protecting these vital interests, we'll ". . . do what we must to defend these interests, including – when necessary – using our military might unilaterally and decisively."[2] Thus, it is the task of the US military to implement this strategy and to do so it must recognize and adapt to 21st Century challenges.

The NSS confers the responsibility for defending US national interests worldwide to the military without focusing on potential threat areas. According to former Chairman of the Joint Chiefs of Staff General John M. Shalikashvili, our military "will be called upon to respond to crises across the full range of military options from humanitarian assistance to Major Theater War."[3] Further, he asserts "[that] despite the best efforts of engagement, it is likely that one or more aspiring regional power will have both the desire and the means to rise up and challenge the United States militarily."[4] One of those aspiring regional powers is specifically named in the US National Military Strategy: North Korea.[5]

To ensure the US has retained the capability to respond to potential challenges, the Joint Chiefs of Staff created Joint Vision (JV) 2010 to guide US military preparations for future conflicts. JV 2010 identifies Focused Logistics as one of the four pillars upon which to obtain Full Spectrum Dominance. Focused Logistics is defined as "the fusion of information, logistics, and transportation technologies to provide rapid crisis response, to track and shift assets even while en route, and to deliver tailored logistics packages and sustainment directly at the strategic, operational, and tactical level of operations."[6] Focused Logistics is the common thread optimizing all force application aspects necessary to achieve Full Spectrum Dominance.

The potential for major theater war in the Republic of Korea (ROK) continues to drive war planning for US forces – plans that rely on the United States Air Force's (USAF) ability to apply the Focused Logistics principles. To sustain the USAF's mission of "putting iron on target," a theater-wide system must exist to rapidly transport required quantities of munitions to the front lines. Until recently, ammunition was moved to support US forces via ships in "break bulk" where every pallet of fuses, bombs, or fins was packed and braced individually inside the ship's hold.[7] Removing this blocking and bracing required significant manpower, causing long on- and off-load times at every port. By employing modular packing techniques, the Containerized Ammunition Delivery System (CADS) can potentially streamline this operation. It is this streamlined capability that is critical to Focused Logistics because it will enable the USAF to deliver appropriate munitions to front line air bases in a rapid, efficient manner.

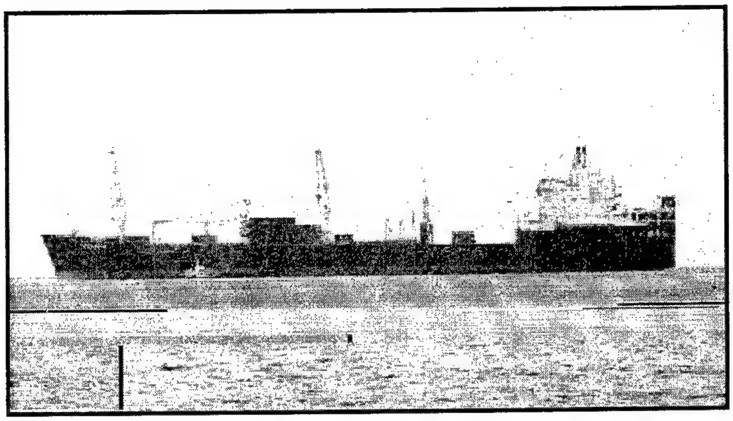


Figure 1. American Merlin container ship

This paper's hypothesis is that USAF main and co-located operating bases (MOBs/COBs) in the ROK lack the infrastructure necessary to support large-scale CADS munitions resupply operations.[8] The USAF's ability to support a CADS operation in South Korean will be examined by comparing current USAF MOB/COB infrastructure deficiencies to existing standards. Since munitions ships used by the USAF (see figure 1) and the Chinhae port facility (see figure 3) meet CADS standards, these aspects of intermodal CADS operations will not be addressed in this study.[9] Therefore, this paper will limit its discussions to the overland transportation and distribution of munitions as well as force structure at USAF MOBs/COBs.[10]

The USAF standard for intermodal operations is the January 1997 Joint Publication (JP) 4-01.7: Joint Tactics, Techniques, and Procedures for Use of Intermodal Containers in Joint Operations. This joint guidance provides the framework to analyze the strengths and weaknesses of the present CADS systems and will be used as the standard to examine USAF base infrastructure on the Korean peninsula. Osan Air Base (AB) will be used as the central example in this paper because its infrastructure deficiencies are representative of USAF bases throughout the peninsula.[11] By determining whether or not the USAF can legally, safely, and efficiently

support small-scale CADS operations, this study will assess whether the USAF can support large-scale CADS operations on the peninsula without incurring significant risks.

The primary source data used for the analysis was obtained from joint and service regulations, joint exercise reports, various staff documents, personal communications with subject matter experts, and unit observations. The arguments presented in this paper will remain unclassified. Therefore no specific planned aircraft sortie rates, estimated munitions consumption analysis, or time phased force deployment data will be used to support the hypothesis. Although this level of analysis would provide data of higher fidelity, the basic argument centers on whether or not safe and efficient CADS operations are feasible at US bases in the ROK. Any quantitative analyses presented are based on numerical data from unclassified sources.

This paper is organized into four parts: Introduction, Background, Analysis, and Summary. Following the Introduction, the Background section provides information on intermodal operations, containerization of munitions, special requirements when transporting/storing munitions, Joint Staff requirements, and an optimum infrastructure description. The Analysis section provides a comparison between the intermodal infrastructure requirements found in JP 4-01.7 and the data regarding infrastructure conditions at USAF MOBs/COBs. The Summary provides an overview of the data with both conclusions and recommendations based on data analyzed in Part III. The conclusions and recommendations forwarded in this section were derived with respect to USAF's commitment to supporting Focused Logistics as outlined by JV 2010.

Notes

[1] The White House, *A National Security Strategy for a New Century*, October 1998, 5.
[2] Ibid.
[3] National Military Strategy of the United States of America. *Shape, Prepare, Respond Now: A Military Strategy for a New Era.* 1997, 2.

Notes

[4] Ibid., 8.

[5] Ibid.

[6] Joint Vision 2010. America's Military Preparing for Tomorrow. 1996, 24.

[7] SMSgt Daniel Mank, "Containerized Ammunition Delivery Systems and Shortfalls." (unpublished background paper for HQ PACAF/LGW), 7 June 1997, 2.

[8] The term "MOBs/COBs" will be used interchangeably with the term "bases" in this paper. These terms refer exclusively to Republic of Korea Air Force bases that have a US presence and have the capability to host combat flying operations.

[9] James R. Gray and Daniel E.Brown, *Memorandum for Record: Trip Report of TURBO CADS 98 Evaluations,* June, 1998, page 5.6.f.11.

[10] Joint Publication 4-01.7. *Joint Tactics, Techniques, and Procedures for Use of Intermodal Containers in Joint Operations*." 7 January 1997, V-1.1.

[11] SMSgt Daniel Mank, E-mail to author on 1 September 1999.

Part 2

Background

Until recently, cargo transported via sealift was handled in relatively small, light packages that were stowed in the ship's hold.[1] Items of significant weight or hazard such as munitions were blocked and braced in place with heavy timbers known as dunnage to secure their location in all weather conditions. In effect, a permanent structure was erected inside the ship's hold to transport munitions.[2] To complicate matters, this "permanent" structure had to be dismantled at the end of the voyage as the munitions were removed from the ship. Despite its time consuming and labor-intensive nature, break bulk packing remained economical since labor was cheap and manufactured goods were expensive. Today, break bulk packing is no longer universally feasible since it is now more efficient and economical to ship via containerized methods.[3] Nonetheless, safety concerns for shipping and handling munitions remain of paramount importance.

The international maritime community recognized these packing deficiencies 20 years ago and created a standardized intermodal shipping system centered on the idea of containerization.[4] Intermodalism is defined as a "type of international freight system that permits transshipping among sea, highway, rail and air modes of transportation through use of American National Standards Institute/International Standardization Organization [ISO] containers, line-haul assets and handling equipment."[5] The keystone of this system, the ISO container, was originally designed in both 20 and 40-foot lengths and could be stored in a modular fashion. Today ISOs

are the standard for intermodal shipping, primarily due to the ease of transitioning from truck to ship to rail and are supported by a wide variety of truck and rail chassis.[6] Using ISO containers, manufacturers can move great quantities of their products from the plant via trucks, cross load it to rail, and then secure it shipboard for a transoceanic voyage. Once the cargo reaches the port,

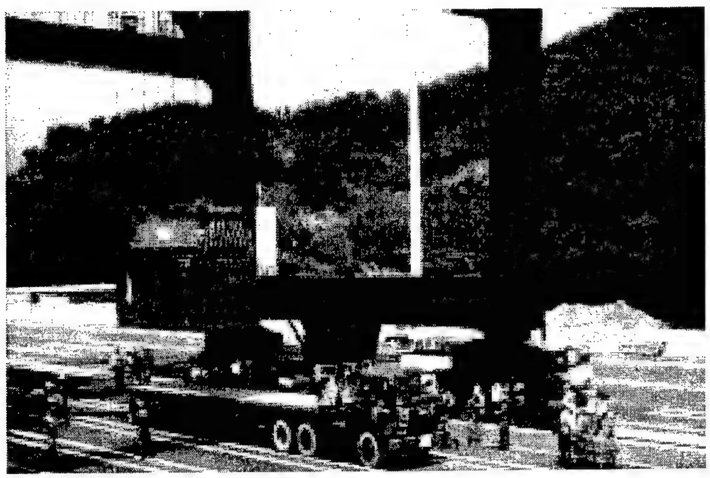


Figure 2. Unloading an ISO container from the American Merlin container ship

ISOs are taken from the ship (see figure 2), moved directly to railcars, and finally trucked to the overseas distributor without the product having ever left the ISO's protection.[7] This intermodal strategy has proven economically feasible and has worked well for the business community.

As world commerce shifted to containerization, this transportation revolution left the shipping industry lacking sufficient numbers of bulk ships to support DOD heavy sealift contingency requirements. This shortage significantly altered DOD wartime surge operations planning and forced a transition towards containerization of the maritime fleet. General Robert L. Rutherford, Commander in Chief US Transportation Command, testified before the Senate Armed Services Committee in February 1995 and provided detailed examples for improving DOD's transportation interface with the commercial sector. There he stated "Our goal is to

promote an effective and efficient intermodal container transportation system by increasing DOD's use of intermodal systems, ensuring interoperability between DOD and commercial systems and maximizing use of intermodal assets and infrastructure."[8]

Containerized Ammunition Delivery System

DOD has implemented CADS as a first step in generating an intermodal transportation system. Through CADS, DOD sought to reduce handling time and increase munitions security at port facilities, railheads, and final destinations by consolidating compatible munitions bound for the same location in 20' x 8' x 8' ISO containers.[9] Handlers can quickly move these containers from the ship (see figure 2) to either a truck chassis or rail car and securely load it in just a few minutes. With munitions blocked and braced inside an ISO container, a 75 percent decrease in handling time can be realized with every in-transit change of transportation mode.[10] In both theater-wide exercises and future conflicts, this decreased handling time will translate to increased container ship throughput at the port. For it's part, the USAF has restructured its dedicated Afloat Pre-Positioning Fleet (APF). Until recently, the USAF APF consisted of three break bulk ships loaded with USAF munitions however, as available technical expertise continued to dwindle, these munitions assets were containerized and new ships commissioned.[11]

Special Munitions Requirements

Replacing ships to carry USAF bomb components in ISO containers however, is only a small part of the whole picture. Transporting munitions requires a multitude of special handling requirements including security and safety constraints unnecessary for general shipping. The most stringent requirement is known as "siting," a process used to certify specific areas to store explosives.[12] The proper siting of storage and handling areas is important to transporting

munitions because safety considerations are paramount. Furthermore, without a properly sited transportation facility, CADS containers cannot change modes of transport.[13]

These "sited" areas are certified using a measuring system known as net explosive weight (NEW) that describes how many equivalent pounds of TNT that can be stored safely in one location.[14] The criteria determining how much NEW a location can accommodate are related to the location's proximity to inhabited work areas and to the level of destruction that would result from unplanned detonations.[15] The rules used to affix a NEW allowance to US managed locations are outlined in DOD Standard (DOD STD) 6055.9. At US ports and installations, it is both illegal and unsafe to store munitions in areas not sited to handle them.[16]

As mandated by the US Code of Federal Regulations (CFR),[17] these siting requirements apply to munitions shipments beginning with the stateside ammunition depots and continue throughout every US-administered stop in transit until the shipment reaches its destination.[18] According to JP 4-01.7, these same laws apply to containerized munitions as well.[19] Ammunition-capable holding sites must include features such as protective berms, lightning protection systems, illumination for night operations, and enough space dedicated for staging trucks and/or rail cars.[20] This list is not all-inclusive but it serves to illustrate the complexity of creating a system that will ensure safe munitions handling operations.

Joint ISO Requirements

In addition to the munitions handling requirements outlined above, specific equipment recommendations for moving ISO containers are delineated in JP 4-01.7. To handle ISOs, facilities from point of embarkation to point of debarkation must either have high capacity cranes with sling adapters, ISO handling forklifts, or permanent ISO hoist systems. For operations in USAF munitions storage areas with organic transportation capability, the assigned truck chassis

must be equipped with ISO hold downs and the towing tractors must have the capacity to tow fully loaded 20' ISO container/chassis combinations; a potential load of over forty-five thousand pounds.[21] If this munitions storage area (MSA) is also conducting simultaneous rail and truck off-loading operations with geographically separated railhead and storage areas, then the local ISO handling requirements for equipment are virtually doubled.

Although JP 4-01.7 denotes the components necessary to create a rapid containerized delivery support structure, it is recognized at theater staff levels that significant portions of these capabilities remain non-existent in the Korean theater of operations.[22] However, primarily as a result of USTRANSCOM sponsored exercises described below, some infrastructure improvements to the system have been effected.

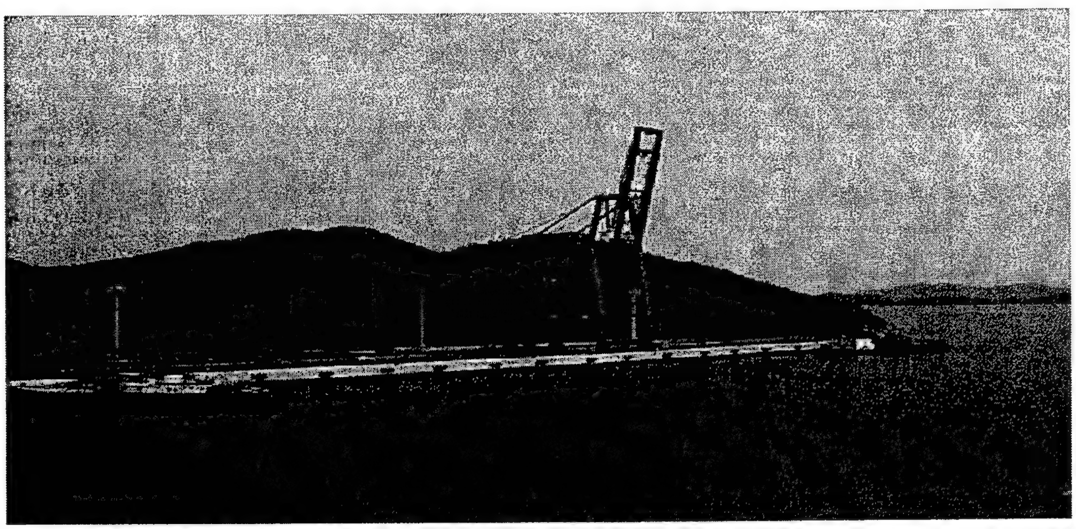


Figure 3. Chinhae Pier Facility

The most important improvement was the refit of the ROK's Chinhae port facility (see figures 3 and 5). Completed in April 1998, this successful modernization effort lowered the pier draft thus enabling large container ships to dock and off-load.[23] The pier was equipped with a state-of-the-art off-load capability complete with a permanent ISO gantry system, a land-based

ISO handling portable crane, four truck lanes, and two railroad lines (see figures 3 and 4). These improvements, along with the latest 45 ton overhead handlers allow the port facility to off-load 15 twenty-foot equivalent units an hour (see figures 2 and 4).[24] For example, it now takes just over three days to download an APF ship carrying 1,103 ISO containers loaded with USAF air-to-ground munitions.[25] This capability, in conjunction with its remote location, makes Chinhae the ROK's only sited port capable of rapidly transloading explosive-filled ISOs from a container ship directly to railcars or trucks.[26] Although air transport constitutes another option for intermodal transfers from ships docking at the Chinhae port, the closest military runway is two hours away at Taegu AB (see figure 5).[27] Relocating the ISOs to Taegu AB would still involve transfer by rail or truck and therefore air transport is not feasible. This is the primary reason that there are no plans to airlift APF ammunition in ISOs to USAF bases directly from Chinhae.[28]

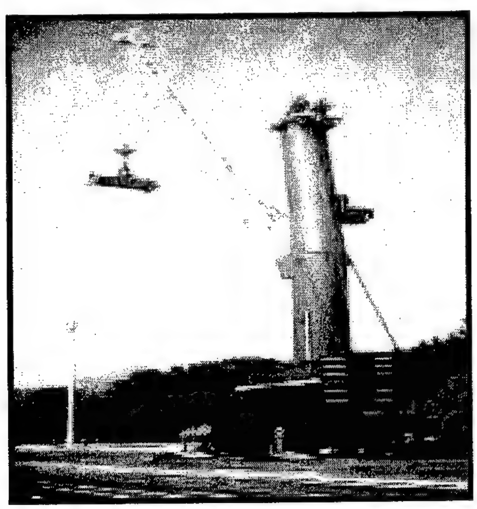


Figure 4. Moveable Crane - Chinhae Pier

USTRANSCOM tested the ROK's capability to transport munitions filled containers to various bases with two TURBO CADS (TC) worldwide munitions movement exercises.[29] TC 98

was significantly more extensive than TC 99 from the USAF perspective and involved three bases: Osan AB, Suwon AB, and Kunsan AB (see figure 5).[30] When the containership arrived at

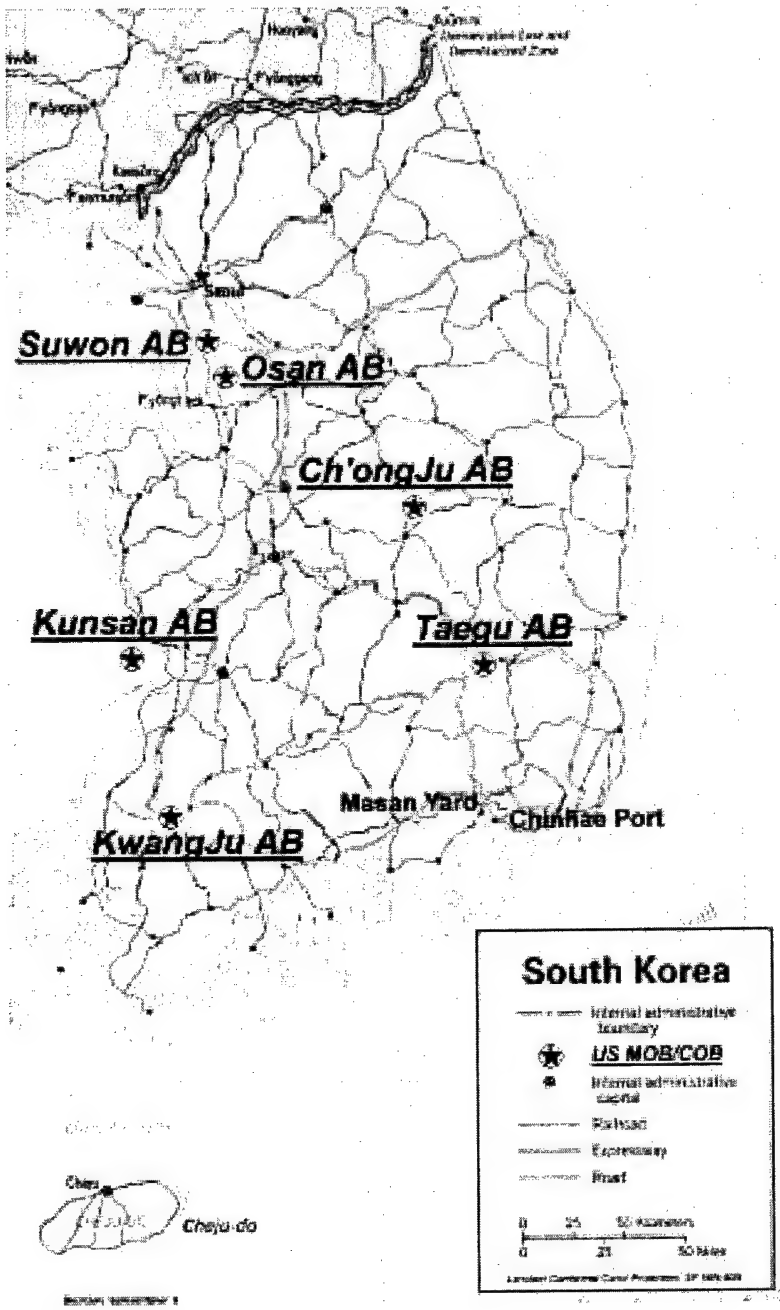


Figure 5. Map of South Korea indicating Chinhae, Masan, and US MOBs/COBs

Chinhae in April 98, over three hundred ISOs were downloaded to railcars and truck chassis. Roughly 260 of these ISOs were destined for Army depots and the remaining 40 ISOs were shipped to the three USAF bases.[31] In conjunction with this limited reception tasking, Osan AB conducted a significant retrograde operation of 53 containers packed with obsolete munitions bound for US depots. From both the reception and retrograde experiences, valuable observations were recorded in both the after action reports and the Joint Uniform Lessons Learned System (JULLS).[32]

Both the TC 98 and TC 99 after action reports confirm the Chinhae facility has the capability to rapidly off-load incoming container ships. However, data gathered regarding the remaining ROK infrastructure indicate that it is inadequate for CADS operations. Although the port facility has realized significant decreases in handling time, the US military can only capitalize on these gains if adequate infrastructure exists to support the remainder of the intermodal system. The infrastructure requirements to support transshipping munitions from the port to the receiving bases and then to return the empty ISOs are outlined in JP 4-01.7.[33]

Intermodal Requirements

Transporting USAF ammunition assets via CADS fully supports the spirit and intent of Focused Logistics by providing the fusion of logistics and technologies to create a rapid, flexible system than can be monitored through all transportation phases. However, CADS cannot function properly without a theater-wide containerized shipping capability.[34] The specific requirements for this capability include properly sited railheads, adequate storage pads for explosives filled ISO containers, munitions routes capable of supporting repetitive, extremely heavy loads, adequate transportation assets, and an in-transit visibility tracking system.[35] If these

requirements can be met, CADS would enable both DOD and host nation personnel to train and exercise the system at a sufficient tempo to prevail in conflicts.

CADS Operations

As it exists today, CADS is a "push" logistics system rather than a "pull" system. In a push logistics system, containers arriving at a port are immediately shipped directly to their pre-determined destinations regardless of base requirements.[36] When a USAF APF ship docks, port handlers rapidly download its cargo to allow other containerized supply ships to dock. At Chinhae, a full complement of roughly one thousand one hundred ISOs (see table 1) from an APF munitions ship can be downloaded in just over three days.[37] There are currently no ammunition holding areas at the dock and no plans to construct any. Since these ISOs cannot be staged at the dock due to space limitations, they have to be directly distributed to receiving bases via rail or truck. This rapid distribution scheme minimizes the risks at the port facility while quickly delivering the munitions to the bases.

To illustrate the optimal CADS process in the ROK, a hypothetical scenario is described below and diagrammed in figure 6. Sometime after hostilities begin, an APF munitions ship arrives at Chinhae. Munitions-laden ISO containers are rapidly removed from the ship and loaded onto rail cars or truck chassis at a rate of one ISO every four minutes.[38] Rail cars are loaded and forwarded to the Masan Rail Yards (see figure 5) where the containers' destinations are determined.[39] These cars are shifted onto tracks dedicated to specific locations and, once a train reaches its maximum capacity of 25 rail cars,[40] it departs for one of six USAF bases as its final destination (see figure 5).[41] If ISOs are loaded onto individual trucks at the pier, the drivers receive their destination by USAF port handling teams and depart immediately.[42]

Munition Type	Required Amount	No. of ISOs	Total Weight	Total NEW*
GBU-12	240	10	145,680	46,080
GBU-10	360	30	759,600	340,200
GBU-24(109)	472	59	1,119,584	252,520
GBU-24(84)	828	69	1,867,968	782,460
GBU-27	100	13	218,500	53,500
MK-84 Air	3,616	226	7,221,152	3,417,120
MK-82 Air	7,056	147	3,760,848	1,354,752
CBU-87	7,944	331	7,538,856	1,191,600
AGM-88B/C	396	33	314,820	73,656
AGM-65D	1,000	115	485,000	125,000
AGM-65G	200	17	133,000	60,000
MJU-7	50,100	4	35,070	0
MJU-10	5,000	1	12,500	0
M-206	15,000	1	6,450	0
RR-170	40,000	3	16,000	0
20MM	243,963	5	195,170	0
30MM	478,430	34	956,860	0
M904/M905 Fuzes	3,600	5	18,000	0
Totals	858,305	1,103	24,805,058	7,696,888

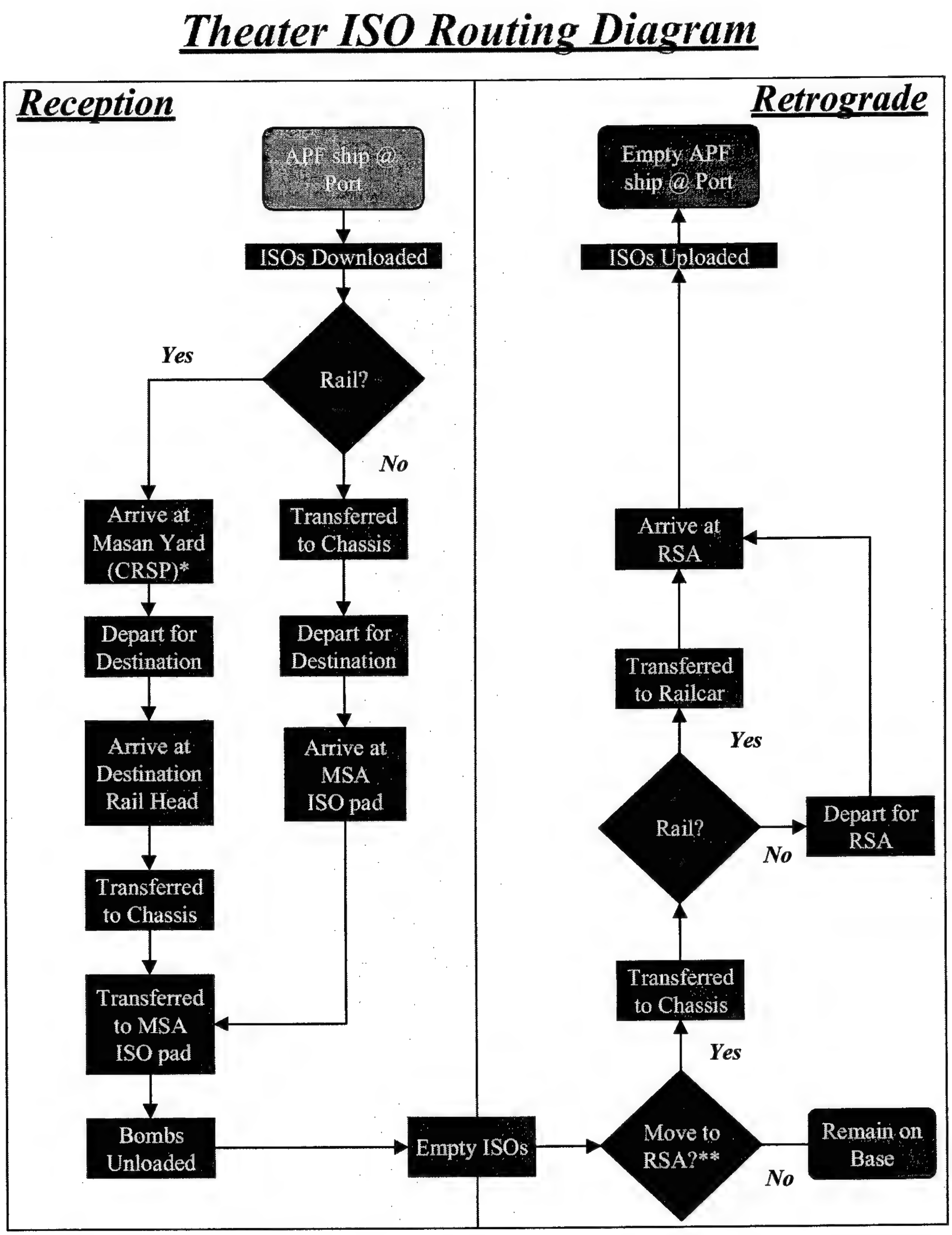
* - The NEW listed in this table refers to 1.1 Hazard Class munitions

Table 1: Munitions Inventory of the APF Ship MV Fisher

Seventh Air Force munitions staff has total asset visibility as the Regional Ammunition Control Point and directs container delivery destinations back through the Regional Container Control Activity. [43] They compare base inventory data consolidated from the USAF Combat Ammunition System (CAS) with the data received from the theater's in-transit visibility (ITV) system. This ITV system uses radio frequency tags to track individual containers and complete

load data is downloaded from the Global Transportation Network.[44] After analyzing this data and redirecting incoming munitions, Seventh Air Force munitions staff alerts the receiving bases' leadership of the shipment and its contents.

At each base, the Munitions Flights realign the workforce to receive, inspect, and transport ISO containers to a sited holding pad. Having received advanced warning of the ammunition types and components arriving, they determine which ones are critical to sustain the operations and ensure they are delivered to the bomb build-up site first. While awaiting the ISOs' arrival, truck chassis are staged for rapid redeployment of critical components to the bomb build-up area. When the train arrives on base, it is staged at the railhead containing the ISO pad and handling equipment. ISOs are inspected and either left on the pad for "unstuffing" or moved to a truck chassis for delivery to the munitions build-up area. At the build-up area, the receiving team off-loads the ISOs from the truck chassis onto a sited ISO pad for safety inspections and component inventory. Once emptied, these and other empty ISO containers are reloaded onto the railcars for retrograde transport to Masan.[45] This complete process is illustrated in figure 6.



Key:
* - Central Receiving and Shipping Point (JP 4-01.7, VI-22.)
** - Retrograde Storage Area. Decision is effected by the Container Control Authority. (JP 4-01.7, V-4.)

Figure 6. Theater ISO Flow Diagram

Notes

[1] Mank 1997, 1.

[2] MSgt John Bennett. Local TURBO CADS 98 planning meeting with author, Osan AB, Korea, 15 August 1997. MSgt Bennett was the lead NCO coordinating TC 98 from the Seventh Air Force staff until he was reassigned to the 51st Munitions Flight and took over as TC 98 lead coordinator and team leader. MSgt Bennett spent 3 years on the 7 AF/LGW staff and holds a USAF master munitions manager rating.

[3] Gerhardt Muller. *Intermodal Freight Transportation*, 3rd ed. Lansdowne, VA. Eno Transportation Foundation. 1997.

[4] Chong K Kim. An Analysis of Containerization of Ammunition Efforts in the Republic of Korea and the United States. Master's thesis, Naval Postgraduate School, Monterey, California. April 1996, 1.

[5] Joint Publication 4-01.7. *Joint Tactics, Techniques, and Procedures for Use of Intermodal Containers in Joint Operations*." 7 January 1997, GL9.

[6] "National Defense Role." In Transportation Institute home page. n.d. (post 1996), 7.

[7] "Intermodalism: Bringing It All Together." In APL home page [web site]. 2000.

[8] General Robert, L. Rutheford, "Working Together for Defense Transportation System 2010." Washington, DC. 23 February 1995 – [cited 10 April 1995], 11.

[9] Joint Pub 4-01.7, II-24 and fig II-6.

[10] Kim, 3.

[11] Mank, 1997, 2. The last ship, the *Buffalo Solider* is slated to replacement by FY 01.

[12] Specific siting requirements found in DOD 6055.9 STD, ch. 5.

[13] Air Force Manual (AFMAN) 91-201. *Explosives Safety Standards.* 1 May 1999, 85.3.16.7.

[14] Department of Defense (DOD) Standard 6055.9. *DOD Ammunition and Explosives Safety Standards.* July 1999, AP1.1.1.64.

[15] Ibid., C5.2.2.7.2.

[16] Public Law 91-596 charges "the head of each Federal agency to establish and maintain an effective and comprehensive occupational safety and health program which is consistent with the standards promulgated under section 6." Department of Defense Directive 6055.9 (26 July 1996) establishes the Department of Defense Explosives Safety Board (DDESB) and codifies their explosive safety standards found in Department of Defense Standard (DOD STD) 6055.9 (1 July 1999) as the minimum binding legal standard consistent with the US Attorney General opinion of October 27, 1949. DOD 6055.9 STD's primary function is to "establish safety standards applicable to ammunition and explosives . . . during . . . transportation, handling, storage. . ." and therefore establishes the minimum safety standards as set forth in rule of law.

[17] U.S. Code of Federal Regulations, Title 49, 1 October 1999. *Transportation.* part 176.4 and U.S. Code of Federal Regulations, Title 33. 1 July 1999. *Navigation and Navigable Waters.* parts 6, 109, 110, 125, 126, and 160.

[18] US Flag vessels fall under the provisions of 33 CFR 126.19 (c) while quantity-distance (NEW) limits are established by the DDESB in accordance with DODI 6055.9.

[19] Joint Pub 4-01.7, xiii.

[20] Requirements found in DOD 6055.9 STD ch. 5, 6, 7, AFI 21-201 sec. D .

[21] Joint Pub 4-01.7, II-8, fig II-5a.

Notes

[22] There have been several reports and briefings generated from HQ USAF, HQ PACAF, and HQ Seventh Air Force concerning CADS deficiencies in the ROK. Specifically, AFIA's 1998 *Eagle Look* report, January 2000 HQ PACAF/LGW briefing to PACAF/CC, and April 1998 7 AF/LGW-LGT ISO pad-railhead survey.

[23] MSgt Dennis Addington. E-mail to author 1 February 2000. MSgt Addington validated that the pier's depth was increased to allow pierside off-loads of container ships. MSgt Addington has spent 20 years in the USAF and is a career munitions manager. He has worked on the Seventh Air Force staff for over 2 years and replaced MSgt John Bennett as the containerization expert.

[24] Ibid. one 20 foot equivalent unit (TEU) = one 20 foot ISO container.

[25] Department of the Army/MTMC, 597th Transportation Terminal Group. "APF SITREP as of 17 Dec 99." Situation report. Military Ocean Terminal Sunny Point, NC. 17 December 1999.

[26] Mank, 1999.

[27] MSgt John Bennett, "TURBO CADS Concept of Operations." Concept of Operations for the 51st Munitions Flight, Osan Air Base, Korea, 1997. 3.

[28] CDR Lou Walker. Telephone conversation with author 8 March 2000.

[29] USTRANSCOM TURBO CADS 99 Exercise Directive, 8 January 1999 and USTRANSCOM TURBO CADS 98 Exercise Directive, 12 November 1997.

[30] For the purposes of this paper, the term "USAF bases" will refer only to the main, and co-located, operating bases in the Republic of Korea. The six bases referenced are: Osan AB, Kunsan AB, Suwon AB, Taegu AB, Quang Ju AB, and Ch'ongju AB. These USAF bases will also be referenced as MOBs/COBs in some areas of the paper.

[31] MSgt Gary Hofstetter, E-mail to author on 3 March 1998.

[32] TURBO CADS Joint Uniform Lessons Learned 1998 and 1999 (draft). Personal communication (e-mail) from CDR Lou Walker, USN stationed at USTRANSCOM/TCJ4-LTI, Scott AFB, IL on 19 Jan 2000.

[33] Joint Pub 4-01.7, V-5.1.h.

[34] *Eagle Look: Munitions Infrastructure and Storage Capability.* PN-98-604. Kirtland AFB: Air Force Inspection Agency. 2 March 1999, 39.

[35] Joint Pub 4-01.7, chapters V, VI, and Executive Summary.

[36] CDR Lou Walker,. Telephone conversation on 8 March 2000.

[37] With a download capability of 15 ISOs and hour, it would take 73.5 hours of continuous downloading at Chinhae to completely offload an APF ship.

[38] Joint Pub 4-01.7, V-4.

[39] In a July 1994 memo, Secretary of the Air Force Widnall exempted the USAF from siting overseas ports and railheads used for the transshipments of munitions allowing Chinhae and Masan Rail yards to legally off load and transfer USAF munitions. Pursuant to paragraph a. of the memo, this exemption does not apply to installations that use explosive siting criteria therefore requiring US installations to comply with the standards outlined in DOD 6055.9-STD.

[40] Bennett, 1997, 3.

[41] Mank, 1999.

[42] SMSgt Mark Eckert. E-mail to author on 14 March 2000.

[43] Joint Pub 4-01.7, IV-2.

[44] Joint Pub 4-01.7, xii.

Notes

[45] Mank, 1999.

Part 3

Issues Analysis

USAF MOB/COB Deficiencies

The background section described an operation utilizing an optimal ROK-based CADS system with a complete, functional intermodal infrastructure. Unfortunately, the system described above does not exist today. While the port facilities are CADS compliant, the remainder of the system is not capable of sustaining CADS. The system lacks suitable railheads, adequate ISO pads, munitions routes capable of handling increased loads, and proper vehicle support. Furthermore, there is no USAF in-transit visibility system to track contents or containers throughout the transport process.[1] Taken together these problems predicate a systemic failure, an observation supported by a 1999 Air Force Inspection Agency (AFIA) report stating that the above conditions "compromised door-to-door [CADS] throughput."[2] This report echoes observations by various other Pacific Air Forces staffs and Joint Exercise evaluators detailing the deficiencies found at all USAF bases in the ROK.

Railheads

In March 1998 a Seventh Air Force team composed of transportation and munitions personnel surveyed all six USAF MOBs/COBs (see figure 5).[3] They evaluated the railheads' suitability and determined whether existing outdoor munitions storage pads were suitable for the high volume ISO delivery operations associated with CADS. This team reported that every

railhead suffered from constrained space limitations, restrictive siting, and all were in generally poor physical condition.[4] Their report indicates that these conditions would hinder rapid CADS operations by restricting the size of ammunition trains to only a few cars at a time.[5] Such restrictions force longer trains carrying high-volume deliveries from the port to be broken up into smaller trains at off-site, non-US staging yards. The original CADS shipment would therefore have to be delivered to the bases piecemeal which increases the time required for receiving munitions deliveries while simultaneously reducing overall CADS throughput.

In May 1998 the AFIA team visited Korea as part of an *Eagle Look* investigation on munitions infrastructure and storage capabilities worldwide. They performed an in-depth survey of the environment, studied the infrastructure, and interviewed munitions and civil engineering personnel at the same six USAF bases on the Korean peninsula. As noted in the 2 March, 1999 report for the Secretary of the Air Force, railhead deficiencies were a significant contributing factor to the first of the major findings in the report. Specifically, they stated that "distressed and insufficient railheads . . . reduced munitions on-load/off-load efficiency and sustainment capability" and further noted that these deficiencies were "major obstacles to [CADS] implementation."[6] Because of the increased safety risks and physical limitations, all existing railheads are presently unsuitable as safe or efficient links in a CADS transport system.[7]

Osan AB was reviewed by both teams and its railhead deficiencies are representative of the other USAF MOBs/COBs. Osan's conditions are cited here to illustrate the extreme measures necessary to legally, and safely, use these deficient railheads for CADS operations. At Osan, the munitions railhead is insufficient because continued local construction has narrowed the clear zone to approximately three hundred feet.[8] This persistent encroachment has negated any opportunity to site the railhead for CADS operations.[9] As a result, the Department of Defense

Explosives Safety Board declared this railhead "unsitable" in April 1997 and it remains unsited despite multiple waiver requests.[10] The inability to use this railhead for munitions operations adversely impacts Osan's ability to support high-volume ISO reception via CADS.

Legally, Osan's wing leadership cannot authorize use of the base's current railhead site for CADS without a waiver from the Pacific Air Forces (PACAF) Commander.[11] To apply for a waiver, the leadership must consider all possible measures to ensure the safety of the affected personnel, perform a risk assessment with these measures in place, and forward this request to the approving authority.[12] To solve the encroachment problem, the wing commander could consider establishing a temporary clear zone during CADS operations. However, even a minimal seventy-five thousand pound NEW capacity capable of supporting as few as two railcars,[13] would require a 1724-foot clear zone.[14] This clear zone would impact a large civilian population, increase the risks to aircraft arm and dearm operations, close some base messing facilities, and displace hundreds of dormitory occupants. Overall, this temporary evacuation would involve thousands of people and adversely compromise base operations while the ISOs are downloaded.

Implementing these extreme measures would only allow for a relatively low amount of NEW capacity at the railhead at one time. To illustrate, using an average of the NEW values for ISO containers aboard the APF ship (table 1) it would take at least 22 hours of continuous operations to receive 48 ISOs.[15] For a delivery of higher NEW explosives such as a shipment of ISOs loaded with two-thousand pound MK-84s, the downloading time would increase to 33 hours (see appendix A). Assuming an even distribution of ISOs from the APF ship to all six USAF bases in Korea, each base would receive 184 ISOs in less than a three-day period. Under these conditions, the established temporary clear zone will be insufficient to process the

projected amounts of NEW arriving from the port. Thus, the lack of railhead capacity at receiving bases will force leaders to make one of two decisions. They can elect to receive the munitions as they arrive from the port at unsited railheads, which will effectively maintain the system's high volume throughput but compromise safety measures. Alternatively, the base leadership could deny these ammunition-laden rail cars entry to the base and they will accumulate on Korean National Rail system railcars at holding yards throughout the peninsula. Since these holding yards are not DOD managed, they have no NEW requirement.[16] Such a decision will negatively impact the rail system's throughput capacity since the rail cars will be "offline" awaiting USAF action to download them. Furthermore, staging ammunition at holding areas is contrary to the purpose of Focused Logistics, which is to deliver logistics packages "directly to the operational and tactical levels of operation."[17]

Joint Pub 4-01.7 states that "rail should be used to move containers as far forward as possible" but without adequate rail reception capability, the system will back up.[18] An alternative to binding these assets in the rail yards would be to contract more trucks either at the pier or have truck drivers pick up the ISOs at the rail yards. Even if the USAF rail restrictions regarding ISO throughput could be alleviated by contracting sufficient truck chassis and drivers, every USAF base faces a more significant throughput restriction – a lack of sited ISO pads.

ISO Pads

Due to storage and safety concerns, ROK port authorities will not allow the seven million plus pounds of NEW (table 1) to accumulate at Chinhae pier. Joint Pub 4-01.7 directs theater logisticians to "ensure that containers arriving in theater are promptly discharged and rapidly moved forward to the central receiving and shipping point or their final destination."[19] Therefore, the ship's ammunition containers will be processed to receiving bases as rapidly as possible.[20]

Whether the ISOs travel by rail or by truck chassis, every USAF base in the ROK lacks the capacity and the siting to handle the expected flow of ISOs.[21] Without specifically designed and sited ISO pads, wing leaders would be forced to illegally accept greater than one million, two hundred fifty thousand pounds of NEW onto each base.[22] This decision, while sustaining combat operations, will significantly increase safety risks to personnel. To avoid potential legal or safety ramifications, the wing leadership could perform a risk assessment and request a waiver from the HQ PACAF Commander.[23] However, this waiver will not alleviate the physical risks involved with exposing base personnel to large stockpiles of munitions stored in areas not sited to handle the NEW.

Osan AB's single large MSA outdoor holding pad is a clear example of the inadequate ISO container storage capability in place throughout the peninsula.[24] Although its thirty thousand pound NEW-capacity may appear robust, this pad is only capable of storing a maximum of 32 MK-84 general-purpose two thousand pound bombs.[25] Given this limitation, Osan AB munitions personnel could legally place only two ISO containers filled with a standard shipping load of 16 MK-84s on the pad. The restricted NEW at this pad, and the rest of Osan's MSA, is due primarily to a lack of physical real estate available to the base and continuing encroachment by the local Korean population.[26] Thus, there is not an expedient solution to permanently increase the size and/or the NEW capacity of this specific outdoor storage pad. In March 1998, the Seventh Air Force munitions team's survey identified similar ISO pad deficiencies at every other USAF MOB/COB. The team concluded that no base has the NEW capacity to handle neither large-scale ISO operations nor the available land to solve the problem.[27] The 1998 AFIA *Eagle Look* team also confirmed that the USAF base munitions-holding pads in the Korean theater were deficient. Their report cites "inadequate size, insufficient NEW capability, and insufficient

weight bearing capability" at a majority of the holding pads as the primary factors leading them to conclude these sites were inadequate to support CADS.[28]

The Seventh Air Force team also compared each base's outdoor holding areas against the ISO pad construction standard of reinforced concrete capable of supporting thirty thousand pounds per square foot – none of the sites met the standard.[29] The team's concerns about substandard ISO pad construction were validated during the TC 99 exercise at Osan AB. During this exercise, a 50K all-terrain handler seriously damaged the asphalt holding pad by breaking through the surface and created deep ruts after moving less than 10 ISO containers.[30] Since similarly constructed outdoor pads exist on all USAF MOBs/COBs, it follows that they too have the same limitations in ISO NEW storage ability, as well as insufficient weight bearing capability, making them equally unsuitable for CADS operations. These findings were briefed to the current PACAF Commander, General Gamble, on 21 January 2000 by the PACAF Munitions Division Chief stating that "neither Korean MOB [Osan or Kunsan AB] has … an adequate container pad at either location to handle incoming munitions."[31] These findings highlight the systemic lack of ISO holding capacity in the ROK. Furthermore, these reports confirm that the substandard ISO pad capability will severely constrain CADS operations.

Roads

The compromises in munitions container-handling capability resulting from unsuitable railheads and inadequate ISO pads are compounded by another base level problem; inadequate base road systems. Whether they arrive on base via rail or truck from Chinhae, ISO containers must be transported over primary munitions routes to the base's MSA. If the base roads are not capable of handling these stresses, they will quickly become unusable for normal traffic.

All CADS operations require high capacity equipment capable of moving and transporting ISOs that could weigh as much as forty-five thousand pounds.[32] The primary piece of equipment used to lift and transport ISOs is the fifty thousand pound capacity Rough Terrain Container Handler (50K RTCH). The 50K RTCH weighs one hundred six thousand, eight hundred pounds when it is fitted with the required 20-foot ISO handler.[33] With a maximum load, this 50K RTCH has a front loaded axle weight of ninety-eight thousand pounds and creates twenty-four thousand, five hundred pounds per square foot under its front wheels. When unloading ISOs from a 25-car train, a 50K RTCH could conceivably traverse the same route nearly one hundred times thus the surface must be capable of repeatedly withstanding this massive weight.

The 50K RTCH, deployed to both Osan and Kunsan ABs, is designed to traverse rough terrain when fully loaded.[34] When the RTCH travels on any road not capable of handling the weight, asphalt surfaces simply buckle without significantly slowing the forward movement of the vehicle or its cargo. Therefore, although the 50K could conceivably transport ISOs over this surface even while inflicting further damage, it eventually would render the road unsuitable for normal trucking operations. During TC 98, this phenomenon was reported to USTRANSCOM observers by a USAF senior NCO who described the asphalt as having "rolled beneath the front tires of the [RTCH] forklift."[35] Immediately after this damage occurred, base Civil Engineering (CE) Squadron roads/pavements experts were called in to assess the damage. They concluded that the existing roads and handling pad in the MSA were inadequate to support the repeated 50K RTCH operation. Their observation was later reinforced by a 1998 Osan AB ISO handling feasibility study that concluded the surface most suitable for handling this type of load is 8-inches of reinforced concrete and not asphalt.[36] The engineers also demonstrated concern for repeatedly transporting heavily loaded ISO chassis along all base munitions routes.[37]

One month after TC 98, the AFIA *Eagle Look* team arrived at Osan AB and the team's CE experts were able to view this damage shortly after it occurred. Their findings matched the base CE pavement expert's opinion concerning the roads and this was directly reflected in their final report. "The team noted deficient roads leading to and within several MSAs that were main CADS thoroughfares and primary munitions delivery routes to combat aircraft. The combination of heavy loads and erosion created hazardous road conditions, jeopardizing readiness and safety."[38] The report further noted "at one major MSA [Osan] roads were in such degraded condition they were unsuitable for heavy operations (i.e. 50K forklift) forcing the use of alternate, less suitable routes." [39]

If asphalt were to be used for roads supporting tractors and ISO/chassis combinations, the sub-base would have to be at least 6-12 inches of crushed gravel topped by a minimum of 7 inches of asphalt.[40] Unfortunately, the majority of roads currently found on USAF bases in Korea consist of 2-3 inch thick asphalt construction over a limited capacity sub-base.[41] Originally built over 30 years ago, these roads were never designed for supporting repeated carriage of extremely heavy special purpose equipment or heavily loaded ISO-chassis combinations in excess of forty-five thousand pounds.[42] It appears likely that these inadequate base roads could sustain heavy damage during a full scale CADS operation that would significantly impact the ability to maintain an optimal munitions transport route.

Vehicles

In addition to unsuitable railheads, inadequate ISO storage, and weak road systems, the data indicate there is insufficient vehicle capability to support CADS operations at the base level. Joint Pub 4-01.7 outlines the basic vehicle capabilities necessary for surface transport of ISO containers, specifically identifying 34 tons as the necessary capacity for transport vehicles

towing 20-foot ISO containers.[43] However, at USAF MOBs throughout the ROK, Munitions Flights are only authorized 7.5-ton tractors that do not meet JP 4-01.7's requirements. As noted in the 51st Maintenance Squadron after action report, these 7.5-ton tractors are not capable of pulling more than one partially loaded 20 foot ISO/chassis combination at one time although the chassis itself is designed to carry two 20 foot ISOs simultaneously.[44] Depending on ISO contents, this situation will increase time needed to download CADS trains, decrease throughput, and limit a unit's flexibility and efficiency.

Another limitation of the 7.5-ton tractors is that they are unable to pull the heavy loads involved in CADS movements up steep grades. This may be a critical failure since the Korean landscape is characterized by steep hills and these types of sharp inclines are found on many of the USAF bases in the ROK.[45] When senior munitions leaders develop base munitions employment plans, the logistics and safety experts choose multiple munitions transportation routes to avoid populated and critical function areas while placing less emphasis on the route's topography. This approach maximizes survivability in case of enemy attack, provides increased flexibility, and enables the Munitions Flight to continue operations without unduly jeopardizing base and civilian personnel. Thus, the hilly Korean terrain is problematic since many established and certified munitions routes cross these hills.[46] Depending on the grade and road conditions, the 7.5-ton tractors currently available are incapable of traversing base munitions routes while pulling every type of containerized munitions configuration during CADS operations.

During Osan's TC 98 munitions retrograde preparations, the 51st Transportation Squadron recalled the last of the Munitions Flight's 10 and 15-ton tractors. These tractors were replaced with 7.5-ton models pulled from long-term storage at one of the COBs. Since the unit was in the middle of TC 98 preparations, these tractors were immediately put to use relocating loaded ISO

containers. One specific container was loaded with approximately fifteen thousand pounds of MK-82s and moved over the base's primary munitions route that included steep hills.[47] When the 7.5-ton tractor attempted to climb the hill with the load, it was unable to do so despite multiple attempts and highly experienced operators.[48]

This is significant because this load was relatively light; seventeen thousand pounds lighter than a comparable ISO loaded with MK-84s. In Osan's case, the old tractors were used to support the remainder of the TC 98 exercise.[49] While this temporary use of the recalled equipment enabled the exercise to continue, it is unlikely that similar solutions will be available on every base during a potential conflict. Without sufficient numbers of heavy-duty tractors to support ISO container movement, USAF units on the ROK would certainly not be able to expeditiously handle inbound ISOs as set forth in JP 4-01.7.[50]

In-Transit Visibility

Although USAF deficiencies in adapting to transportation and logistics advances in containerization have already been addressed, there remains a major obstacle to achieving Focused Logistics – a complete lack of automated in-transit visibility (ITV) in the ROK. When the APF ship arrives in theater and downloads its ISOs, the responsibility for ITV shifts from USTRANSCOM to the theater's movement control element (MCE). As such, the MCE will "continue movement control of the unit and their equipment to its final destination."[51] Without real-time data tracking at a centralized control function, theater-level ammunition control and movement personnel will be unable to predict overall munitions needs or make accurate decisions for moving critical components to the bases where they are required.[52] At the base level, leaders need to ascertain which munitions are loaded in each ISO container, where they are located, and how fast they can be delivered. With this information, leaders can better determine

which munitions, and thus, which ISOs are critical to sustain their production effort. Up-to-date information is of paramount importance since munitions requirements may change rapidly during a wartime situation. Specifically, the lack of CADS ITV is evidenced by the inability to track individual ISOs once they depart Chinhae. In addition, there is no existing method to quickly determine the contents of any specific ISO container.

According to the JULLs for TC 98 and TC 99, there is no ITV capability at USAF bases in the ROK because "there is currently no [automated] tracking system in place to monitor the movement of the stock from the port to the storage location."[53] This system lacks two critical pieces of equipment; radio frequency (RF) tags on APF ISOs and a base level RF receiver. US Army ISO containers are fitted with radio frequency (RF) emitters to track their movements by the shipping companies, the originating depot, and USTRANSCOM.[54] To date, the USAF APF ISOs have not been equipped with RF tags nor are there any permanent RF receivers installed at any of the MOBs/COBs. This is because the USAF has not elected to pursue this technology.[55] For TC 98, USTRANSCOM "tagged" all exercise containers and acquired mobile receivers from non-participating US Army units. They loaned these "extra" receivers to the receiving USAF bases so USTRANSCOM could evaluate the entire exercise.[56] Although this interim measure was successful for TC 98, this temporary solution would not be feasible during a theater-wide conflict since the Army would need these tracking resources.

The second ITV deficiency on the ROK is the outdated USAF CAS munitions inventory system. CAS is a multi-level database and tracking system designed in the 1980's that is installed throughout the USAF.[57] CAS' interface is archaic by modern standards and is incapable of providing real-time information to logisticians at all levels.[58] This lack of a responsive, time-sensitive inventory system seriously undermines CADS capability at USAF bases worldwide.

Recent experiences from Operation ALLIED FORCE in Kosovo illustrate why the existing CAS automated munitions databases need to interface with real-time ITV systems such as the RF tag/receiver system. According to the United States Air Forces in Europe Director of Logistics (USAFE/LG), real-time status was "paramount to mission planning and timely munitions status. i.e.; mode of transportation and time of arrival of munitions in transit."[59] They determined that CAS was not capable of processing the real-time data workload or interfacing with other tracking systems necessary to support ITV.[60] With this capability notably absent during Operation ALLIED FORCE, the USAFE/LG staff was forced to reinstate manual tracking methods.

These highly inefficient manual procedures forced the staff to take extreme measures to move munitions to the appropriate locations. Their "lessons learned" message stated "we were often forced to schedule an 'emergency resupply' for our forward deployed units when munitions were consumed more quickly than we anticipated and we were unable to monitor status of the stockpile in a timely manner. These 'emergencies' caused us to use scarce intra- and inter-theater airlift to fill munitions needs we should have been able to predict and thus use surface transportation."[61] To mitigate the manual tracking system inefficiencies, USAFE/LG staff "required units to perform repeated physical inventories and report balances before distribution decision(s) could be rendered."[62] Repeated physical inventories are costly in terms of personnel hours and contribute to decreased unit flexibility since they remove personnel from the production effort. This lack of ITV during Operation ALLIED FORCE underscores the need for the USAF to make every effort to modernize current tracking systems to support all aspects of Focused Logistics.

Although the Kosovo experience demonstrated the need for CAS to interface with ITV components, the CAS system throughout the USAF has not been upgraded. Currently, there are

no plans to modernize the CAS accounting software to either process real-time data or to link with RF tag identification.[63] In effect, the same deficiencies that created problems in Kosovo exist in the ROK today. Without ITV capability, munitions planners will be unable to track and redirect incoming munitions as they arrive on the Korean peninsula, which limits munitions planning. If an operational ITV system were in place, Seventh Air Force might be able to mitigate the problems caused by the multiple infrastructure deficiencies by potentially metering the flow of ISO containers to the forward bases. At a minimum, the staff would have an accurate picture of where each logistics package is located at all times. As it stands, this current lack of ITV not only decreases CADS throughput capability both in training and/or wartime operations, but it violates the specific intent of Focused Logistics.

Notes

[1] MSgt Gary Hofstetter and MSgt Dennis Addington. "Container Handling Assessment." Briefing to the United States Forces Korea J4 staff. Youngsan Army Garrison, Korea, March 1998. and Gray, James R. and Brown, Daniel E., *Memorandum for Record: Trip Report of TURBO CADS 98 Evaluations,* June, 1998.

[2] *Eagle Look: Munitions Infrastructure and Storage Capability.* PN-98-604. Kirtland AFB, NM: Air Force Inspection Agency. 2 March 1999, 40.

[3] The six USAF MOBs/COBs are Osan AB, Kunsan AB, Suwon AB, Taegu AB, Ch'ongju AB, and KwangJu AB.

[4] Hofstetter and Addington, 1998.

[5] Ibid.

[6] *Eagle Look,* 40.

[7] Colonel Wayne Recknor. "Korean MSA Infrastructure Briefing." Briefing subject presented to General Gamble, HQ PACAF Commander. Hickam AFB, HI, 21 Jan 2000.

[8] SMSgt Kieth Dey. E-mail to the author on 15 April 1998 (referencing a Korean day care facility constructed directly outside the Beta Site railhead's gate at Osan AB).

[9] Thomas J. Davis. *CY98 CDIP, Survey Railroad Spur, Osan AB, Korea: Pre-final submittal.* Yougsan Garrison, Korea: Jung Il Associated Architects Engineers Planners. July 1999, 17.

[10] MSgt John Bennet, "TURBO CADS 98 After Action Report to the Commander, 51st Maintenance Squadron, ROK." After Action Report. Osan AB, Korea. May 1998, 2. Desited in 1997, follow-up waivers to use this railhead have been disapproved by the DDESB in both 1998 and 1999 according to Seventh Air Force munitions staff.

[11] AFMAN 91-201, C5.3.4, and figure 5.2 using the following values; seldom, occasional, and catastrophic. This combination directs MAJCOM approval.

Notes

[12] AFMAN 91-201, ch. 5.

[13] Using the chart at Table I, 30 percent of the ISO's are loaded with MK-84 bomb bodies which have a total NEW of 15,120 pounds. A 75,000 pound NEW at the rail head will only support two railcars loaded with a total of four MK-84 loaded ISO's.

[14] Davis, 17.

[15] The average NEW per ISO was calculated by dividing the total 1.1 NEW by 1103 (the total number of ISOs aboard the APF ship). This yielded an average NEW of 7330 pounds/ISO.

[16] AFMAN 91-201, 167.

[17] *Joint Vision 2010*, 24.

[18] Joint Pub 4-01.7, VI-21.20.b.

[19] Joint Pub 4-01.7, VI-16.18.a.

[20] Joint Pub 4-01.7, V-3.

[21] Recknor, 3.

[22] Referring to Table 1, the total amount of NEW on the AFP ship is approximately 7.7 million pounds. Dividing this figure by the number of USAF MOBs/COBs in the ROK (6) yields 1.283 million pounds per base on average.

[23] AFMAN 91-201, 167.

[24] Delta Pad at Osan AB, Korea is only sited for 10,000 pounds NEW unless the Munitions Flight leadership ceases operations in its Conventional Maintenance Facility and evacuates the shop. Under these conditions, Delta Pad can then accommodate 30,000 pounds NEW at the expense of munitions repair and refurbishment capability. Although refurbishment is not generally necessary during wartime, repair of some munitions components (eg. LAU-131 rocket pods) can become critical.

[25] Armament Product Group Manager Weapons File. 1999, 4-8. A single MK-84 has a NEW value of 945 pounds.

[26] 51st Fighter Wing Chief of Safety, HQ 51 FW Explosive Site Plan Revision (1996) submission to HQ USAF Safety Center. January 1996.

[27] *Eagle Look,* 41. Specific munitions site plans for munitions storage areas are available through Seventh Air Force Safety for the following bases: Osan AB, Kunsan AF, Taegu AB, Suwon AB, Kwang Ju AB, and Ch'ongju AB. None of these bases has an outdoor pad feasibly located on the base proper capable of storing 100,000 NEW.

[28] *Eagle Look,* 41.

[29] A railhead/ISO off load pad site survey conducted 16 July, 1999 concluded that the adjacent ISO pad required 8 inches of reinforced concrete (p 16, fig 4) as the minimum construction standard.

[30] MSgt John Bennett, E-mail to the author on 16 February 2000.

[31] Recknor, 10.

[32] Joint Pub 4-01.7, II-12, fig II-7.

[33] Joint Pub 4-01.7, II-24, fig II-18.

[34] Joint Pub 4-01.7, II-22.

[35] Gray and Brown, page 5, section 6.f.11.

[36] Davis, 16.

[37] This is the personal experience of the author who was present on site when the damage and subsequent assessment occurred. 51st Civil Engineering Squadron roads and pavement

Notes

engineers expressed concern over the repeated usage of the 50K RTCH over base roads. When briefed about wartime ISO movement requirements, they suggested we move our operations off base.

[38] *Eagle Look,* 44.

[39] Ibid.

[40] Robert Monasco, Civil Engineer with the City of Montgomery, AL pavements design section. Telephone call on 15 March 2000.

[41] Lt Col Brent Chubb, 51 FW Civil Engineering Squadron Chief of Operations, 1997-1998. E-mail to author on 10 March 2000.

[42] HQ PACAF/CE engineers stated that neither they, nor the Corps of Engineers who built the roads, have design specifications on them since they were constructed over 30 years ago. However, they did not believe the roads were designed to handle the weights involved with CADS operations since they are significantly higher than is needed to support local traffic. Osan AB Civil Engineering Squadron engineers were also contacted and they too lack specific design criteria on roads currently existing on the base.

[43] Joint Pub 4-01.7, V-8.2.b.

[44] Bennet, 1998, 2.

[45] Mank, 1999.

[46] Ibid.

[47] A MK-82 is a 500 pound general purpose bomb. Weapons File, 4-6.

[48] Bennett, MSgt John, Non-Commissioned Officer-In-Charge, Storage Section. Memorandum for Record. Subject: Failure of 7.5 Ton Tractors to Support TURBO CADS 98. 5 March, 1998.

[49] The author was the Munitions Flight Commander at the time of this incident and personally worked out the arrangements to return the recalled vehicles to the Munitions flight to continue the exercise.

[50] Joint Pub 4-01.7, V-5.

[51] Joint Pub 4-01.7, VI-16.17.a.

[52] Message. 091145Z FEB 00. US Air Force. To HQ USAF/ILM, 9 February, 2000, para. 1.C.

[53] USTRANSCOM/TCJ4-LTI. Draft memorandum (submission). Subject: Joint Uniform Lessons Learned for TURBO CADS 99: Tracking of Containers, Nov 1999, 49.

[54] Joint Uniform Lessons Learned, 50.

[55] Ibid.

[56] The author was present when the unit was delivered to Osan AB in April 1998.

[57] The term "multi-level" refers to the fact that CAS is installed at the depots, MAJCOMs, Numbered Air Forces, and base levels.

[58] Mank, 1999.

[59] Message. 091145Z FEB 00, para. 1.C.

[60] Ibid.

[61] Ibid., para. 1.

[62] Ibid., para. 1.C.

[63] Lt Col Glenn Murphy, Telephone conversation with the author 12 March 2000.

Part 4

Summary/Conclusions/Recommendations

Summary

DOD has begun to implement container-based intermodal operations as the standard for its transportation systems. First, DOD began replacing the APF break bulk munitions ships with the modern containerized ammunition ships. Next, the South Korean government improved the Chinhae pier facility, creating a modern, munitions capable container handling system. This facility, capable of rapidly downloading ISOs and loading them to rail or truck, is the first critical link of a high speed CADS operation.

Since the first two aspects of this intermodal transport system (USAF APF ships and the Chinhae pier) have been successfully modernized, the largest impediment to a streamlined CADS operation is the poor ISO handling capability at the USAF bases in Korea. Joint Pub 4-01.7 clearly delineates the intermodal support elements necessary to successfully execute a rapid CADS operation but, as the data analysis reveals, the current USAF MOB/COB infrastructure lacks the majority of these support elements.

To date, there have been some minimal attempts to upgrade equipment. Some MOBs/COBs have been provided 50K RTCH ISO handlers and truck chassis to perform ISO container operations. However, the remaining infrastructure elements including railheads, ISO pads, roads, vehicles, and ITV systems have not been concurrently modernized and cannot support CADS or

JV 2010's Focused Logistics. The *Eagle Look* team also made this observation concluding in their report that "all units visited stated they were unable to fully implement CADS."[1]

The infrastructure deficiencies revealed by the *Eagle Look* study are wide-ranging and extensive. The Seventh Air Force site survey team identified serious safety flaws with existing railheads ranging from munitions siting issues to a general state of disrepair. Further, the team identified a lack of sited container handling/storage pads to receive CADS ISOs at all USAF bases. Additional observations made during USTRANSCOM sponsored CADS exercises revealed poor MOB/COB road capabilities and a potentially crippling lack of heavy-duty tractors. Finally, ITV system capabilities are not permanently installed at receiving bases and the USAF ammunition accounting system, CAS, is unable to provide accurate real-time information or interface with RF tracking systems. Because of these technological deficiencies, Korean theater planners lack the asset tracking abilities as mandated by JV 2010's Focused Logistics. These systemic failures across CADS operations reveal a safety threat to US troops in the ROK that could be realized should hostilities arise and CADS is implemented using the current infrastructure.

Conclusions

With the exception of the Chinhae port facility, USAF bases in the ROK cannot meet the minimum infrastructure recommendations for CADS implementation outlined in JP 4-01.7 or the safety requirements outlined in DOD 6055.9 STD and AFMAN 91-201. Finally, the current status of USAF CADS operations in the ROK does not meet the expectations of JV 2010's concept of Focused Logistics. The data summarized above support this paper's hypothesis that USAF bases in the ROK currently lack the full infrastructure necessary to support large-scale CADS munitions resupply operations.

Based on the current status of the CADS infrastructure, to implement CADS today base leaders would be forced to assume serious risks to their personnel. The Chinhae port facility will transfer as many ISOs to receiving bases as quickly as possible[2] and since rail is the preferred method of shipment,[3] there will likely be a bottleneck at the bases as munitions crews attempt to download trains while simultaneously supporting flying operations. In a rush to download trains and inventory incoming munitions, there will be an abundance of loaded ISO containers at each receiving bases' MSAs even though there are no safe, sited ISO pads on which to store them. This problem will be exacerbated by a command and control failure due to a lack of ITV at both operational and tactical levels of munitions operations.

One further problem that is not addressed above concerns retrograde transport of containers. The data indicate there are no specific plans to return USAF ISO containers to the shipping destination despite the JP 4-01.7 requirement for retrograde planning.[4] To support Focused Logistics' requirements for precision, flexibility, and responsiveness, the USAF must posture itself to simultaneously support two major theater wars. With respect to worldwide CADS operations, theater planners must have options to not only receive the munitions, but to return the containers to the shipper for reuse and "rearming" if a second regional conflict should erupt. Therefore, forward bases must plan to either store empty ISOs or determine plans to return them to Chinhae or other designated holding locations as outlined in JP 4-01.7.[5]

Recommendations

Every effort must be pursued to alleviate the potential CADS bottlenecks at the USAF bases in Korea to ensure personnel safety while maintaining sustainable combat capability. The two most debilitating deficiencies should be upgraded first: lack of sited railheads and suitable ISO pads. By modernizing these two areas, the base can alleviate the major safety obstacles to CADS

implementation. Bases can receive multiple high-explosive ISOs by rail, which is the more economical method for exercising or operating CADS, and store munitions safely.[6] The reduced costs will enhance realistic training and streamline annual retrograde and call forward actions. More importantly, since railhead and ISO pad modernization efforts can be combined in the same project, negotiations for land acquisition will be much smoother. Ancillary requirements such as berms and lightning protection systems also can be consolidated thus reducing overall costs. Simultaneously, road system improvements to the primary and secondary munitions routes must be developed and implemented. This is critical because once the base can legally receive and store high volumes of CADS ISOs, the data indicate the road systems will quickly fail if not reinforced to handle the repetitive stresses of CADS exercises and contingency operations.

To effect these changes, the Air Staff Installations and Logistics Division (AF/IL) should task the affected Major Commands to develop a master munitions plan directed at real property infrastructure improvements to support CADS operations. To determine the requirements for the Korean peninsula, HQ PACAF, through Seventh Air Force, will have to perform railhead and ISO pad feasibility studies in conjunction with the HQ Air Force Safety Center to ensure proper siting. Additionally, road surveys and current capability studies will have to be performed by base and staff civil engineers along targeted munitions routes since neither the HQ PACAF staff nor the affected bases have the historical data pertaining to each MOB/COB roads' design criteria.[7] The AF/IL should be responsible for consolidating these plans into a single infrastructure improvement initiative in coordination with USFK staff and securing funding as soon as possible.

Next, AF/IL should direct the transportation staff to gather CADS vehicle requirements from HQ PACAF for inclusion into the AF budget. PACAF munitions staff, Seventh Air Force

munitions staff, and base personnel who have experience moving ISOs should determine the minimum special purpose and general vehicles necessary for ISO transport. These requirements must take specific base support, environmental, and terrain conditions as well as JP 4-01.7 requirements into account. This review should also include suggestions to replace currently assigned, hard to maintain ISO handlers with newer, lower footprint models such as the Fantuzzi 45K Super Stacker.[8] Having consolidated these requirements, AF/IL should include these requirements in the budget proposal and give it a high priority.

Since timely information is critical to command and control functions at both the operational and tactical levels, every effort should be made to improve CADS ITV. The Air Force should adopt RF tag tracking technology and completely restructure/reinvent CAS software to a Windows based platform that will interface with Global Transportation Network software.[9] AF/IL should liase with the US Army staff in light of their experiences with RF tagging and ITV. As a minimum, all APF ships should carry RF tagged ISOs and permanent RF tracking capability should be installed at all USAF bases on the peninsula. These actions will allow the Joint Force Commander's staff to view USAF ISO movement data critical to planners at multiple levels. By completely restructuring the CAS concept, tactical and operational planners can then match real-time inventory data to incoming asset data and intercept/redirect critical assets before they are shipped to an erroneous location. This flexibility is not only mandated by Focused Logistics but was shown to be critical in recent Operation ALLIED FORCE experiences.

Finally, the USFK Regional Container Control Activity must develop a theater-wide plan for retrograde container transport. Although the number of containers is unlikely to be a limiting factor in high-throughput CADS operations, these containers consume vast quantities of space at forward operating locations. At some point the containers should be returned to stateside

ammunition depots for refilling. Since the US military must remain poised to fight two, nearly simultaneous regional conflicts, these critical pieces of the intermodal system must be recirculated for maximum efficiency. This retrograde plan can be exercised every year to facilitate normal ammunition retrograde actions while providing excellent training opportunities to munitions personnel theater-wide.

The recommendations detailed above should correct the major deficiencies in USAF CADS operations in the ROK. However, to ensure that high fidelity planning data is available, Seventh Air Force operations planners should conduct a full-scale weaponeering estimate for a long-term conflict using all generations of munitions. With this numerical data, logisticians will be better able to develop long-range plans for full munitions infrastructure improvements, equipment requirements, and munitions consumption rates. This data will enable proper planning and intelligent allocation of ever-shrinking DOD resources. Finally, USTRANSCOM needs to continue TURBO CADS exercises. Since previous exercises have been instrumental in demonstrating the widespread deficiencies within the CADS system, future exercises will be useful to continually re-evaluate the modernization efforts.

The concept of CADS is perfectly aligned with the vision of Focused Logistics in JV 2010. However, there are many significant infrastructure and technology shortfalls in the ROK and throughout the USAF that prevent achieving this vision. This paper has examined the major deficiencies within the current USAF CADS system and finds that the numerical and observational data supported the author's hypothesis. To correct the major deficiencies, the USAF should act on the aforementioned recommendations to fully develop CADS into a functioning icon of Focused Logistics.

Notes

[1] *Eagle Look,* 39.

[2] Joint Pub 4-01.7, V-3.

[3] Joint Pub 4-01.7, V-4.

[4] MSgt Mark Eckert, E-mailto the author on 14 March, 2000 regarding no USAF ISO retrograde plans and Joint Pub 4-01.7, IV-7, 5.c and IV-11, 13.c which delineates the retrograde requirement.

[5] Joint Pub 4-01.7, VI-23.23.d.

[6] Joint Pub 4-01.7, V-4.

[7] Harada, GS-13. HQ PACAF.

[8] Mank, 1999.

[9] Joint Pub 4-01.7, page xii.

Appendix A

ISO Delivery Calculation for Osan AB

This is a sample calculation for transporting 48 ISOs to Osan AB. The Osan AB Railhead is serviced by the Pyong Taek Rail Yards (PTRY) 25 miles from the base. All rail shipments going to Osan AB are routed through PTRY and shifted to the Osan rail spur. Average transit time from PTRY to Osan AB via rail is approximately one hour due to city speed restrictions.[1] Average ISO download time from railcar to truck chassis is 10 minutes. Average time needed to move train cars forward at railhead is 15 minutes per move. After two rail cars are downloaded, the train must be repositioned.[2]

This example involves moving 48 ISO containers to Osan AB with a railhead capable of holding seventy-five thousand pounds net explosive weight (NEW) after extraordinary measures have been enacted. The data in table one yields an average NEW per ISO of 7,330 pounds and a maximum NEW per ISO of 15,120 pounds. An assumption of two hours' notification required to effectively evacuate the base populace and work areas out of the clear zone was used.

<u>Average ISO container calculation:</u>

1a. 48 ISOs ÷2 ISOs/rail car ÷ 5 rail cars/train = 5 trains

1b. 5 trains = 9 one-way train trips = **9 hours**

2. 5 rail cars/train * .5 repositionings/car * .25 hours/repositioning *

   5 trains = **3.25 hours**

3. 10 minutes/ISO download * 48 ISO downloads = 480 minutes = **8 hours**

4. Evacuation notification = **2 hours**

<u>Estimated time for mean NEW ISO delivery = **22.25 hours**</u>

<u>Maximum NEW ISO container calculation:</u>

1a. 48 ISOs ÷2 ISOs/rail car ÷ 2 rail cars/train = 12 trains

1b. 12 trains = 23 one-way train trips = **23 hours**

2. No repositioning required

3. 10 minutes/ISO download * 48 ISO downloads = 480 minutes = **8 hours**

4. Evacuation notification = **2 hours**

<u>Estimated time for mean NEW ISO delivery = **33 hours**</u>

Notes

[1] 51st Munitions Flight Concept of Operations: TURBO CADS 98. January, 1998.
[2] 51st Munitions Flight TURBO CADS 98 After Action report.

Glossary

AB	Air Base
AFIA	Air Force Inspection Agency
APF	Afloat Pre-Positioning Fleet
CADS	Containerized Ammunition Delivery System
CE	Civil Engineers
CFR	Code of Federal Regulations
COB	co-located operating bases
DOD	Department of Defense
ISO	International Standards Organization
ITV	In-transit visibility
JP	Joint Publication
JULLS	Joint Uniform Lessons Learned System
JV 2010	Joint Vision 2010
LG	Directorate of Logistics
MCE	movement control element
MOB	main operating base
MSA	munitions storage area
NEW	net explosive weight
NSS	National Security Strategy
PACAF	Pacific Air Forces
RF	radio frequency
ROK	Republic of Korea
RTCH	Rough Terrain Container Handler
US	United States
USAF	United States Air Force
USFK	United States Forces, Korea
USTRANSCOM	United States Transportation Command

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